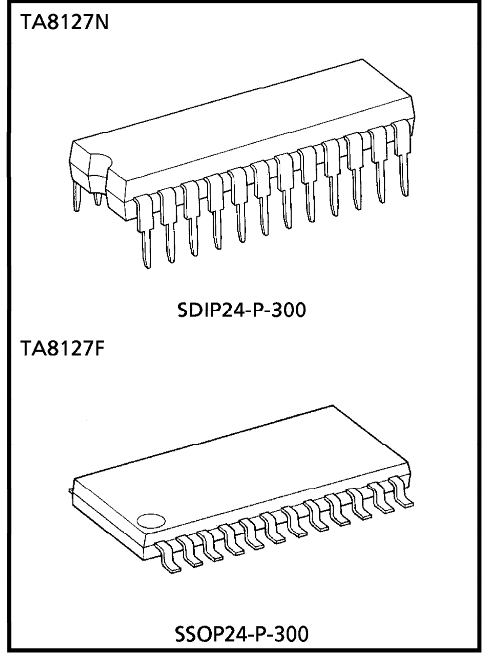
TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT

# TA8127N, TA8127F

SILICON MONOLITHIC

## 3V AM / FM 1CHIP TUNER IC

TA8127N and TA8127F are the AM / FM 1Chip Tuner ICs, which are designed for Portable Radios and 3V Headphone Radios.

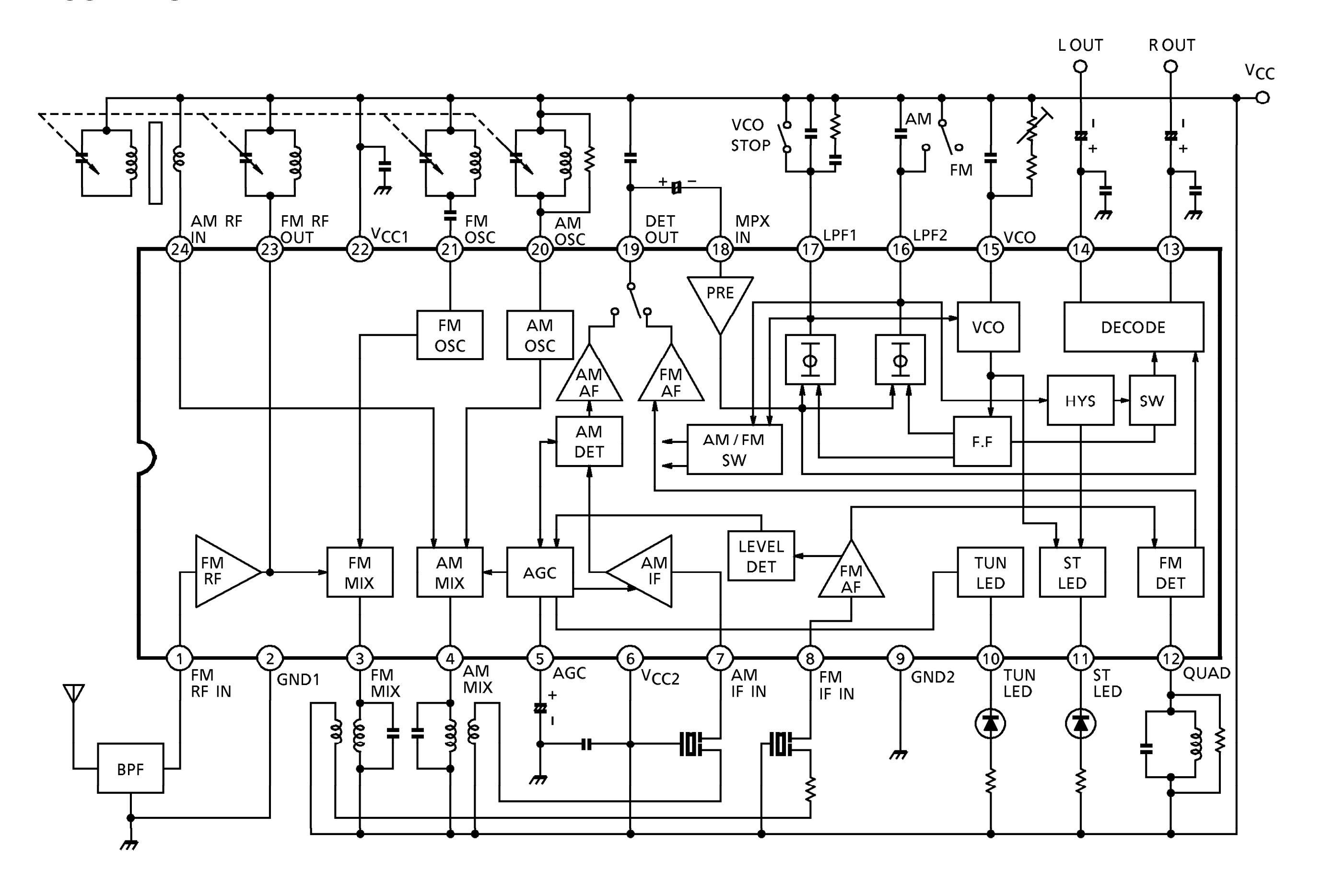



Weight SDIP24-P-300 : 1.2g (Typ.)
SSOP24-P-300 : 0.31g (Typ.)

### FEATURES

- Built-in
  FM F / E, AM / FM IF and FM MPX
- AM Detector Coil and IF Coupling Condenser are not needed.
- Compact Package
  TA8127N : Shrink DIP 24 pin (1.78mm pitch)
  TA8127F : Mini Flat Package 24 pin
- Operating Supply Voltage Range
  $V_{CC}$ = 1.8~7.0V (Ta = 25°C)

**BLOCK DIAGRAM**



## EXPLANATION OF TERMINALS

| PIN NO. | ITEM | INTERNAL CIRCUIT | DC VOLTAGE (V) (AT NO SIGNAL) AM | FM |
|---|---|---|---|---|
| 1 | FM-RF IN | FM-RF OUT (23), (1), GND1 (2), 1kΩ, 50pF | 0 | 0.7 |
| 2 | GND1 (GND for RF Stage) | — | 0 | 0 |
| 3 | FM MIX | $V_{CC1}$ (22), (3) | 3.0 | 3.0 |
| 4 | AM MIX | $V_{CC1}$ (22), (4), MIX, GND1 (2) | 3.0 | 3.0 |
| 5 | AGC (AM AGC) | IF AGC, (5), AGC, RF AGC, GND2 (9) | 0 | 0 |
| 6 | $V_{CC2}$ ($V_{CC}$ for IF / MPX Stage) | — | 3.0 | 3.0 |
| 7 | AM IF IN | $V_{CC2}$ (6), 3kΩ, (7), GND2 (9) | 3.0 | 3.0 |
| 8 | FM IF IN | $V_{CC2}$ (6), 330Ω, (8), GND2 (9) | 3.0 | 3.0 |

| PIN NO. | ITEM | INTERNAL CIRCUIT | DC VOLTAGE (V) (AT NO SIGNAL) | |
|---|---|---|---|---|
| | | | AM | FM |
| 9 | GND2 (GND for IF / MPX Stage) | — | 0 | 0 |
| 10 | TUN LED (Tuning LED) | $V_{CC2}$ 6, 10, GND2 9 | — | — |
| 11 | ST LED (Stereo LED) | 76kHz, 11, GND2 9 | — | — |
| 12 | QUAD (FM QUAD. Detector) | $V_{CC2}$ 6, 12 | 3.0 | 3.0 |
| 13<br>14 | R-OUT (R-ch Output)<br>L-OUT (L-ch Output) | $V_{CC2}$ 6, 13/14, 5kΩ, GND2 9 | 1.0 | 1.0 |
| 15 | VCO | $V_{CC2}$ 6, DC AMP, 15, GND2 9 | 2.5 | 2.5 (VCO STOP MODE) |
| 16 | LPF2<br>● LPF Terminal for Synchronous Detector<br>● Bias Terminal for AM / FM SW Circuit<br>$V_{16} = V_{CC}$ →AM (VCO Stop)<br>$V_{16}$ = Open→FM | 16, AM / FM SW, GND2 9 | 3.0 | 2.2 (VCO STOP MODE 2.7) |
| 17 | LPF1<br>● LPF Terminal for Phase Detector<br>● VCO Stop Terminal<br>$V_7 = V_{CC}$→VCO Stop | 17, DC AMP, GND2 9 | 2.7 | 2.2 |

| PIN NO. | ITEM | INTERNAL CIRCUIT | DC VOLTAGE (V) (AT NO SIGNAL) | |
|---|---|---|---|---|
| | | | AM | FM |
| 18 | MPX IN | | 0.7 | 0.7 |
| 19 | DET OUT | Ⓐ LOW→FM, HIGH→AM<br>Ⓑ LOW→AM, HIGH→FM | 1.5 | 1.2 |
| 20 | AM OSC | | 3.0 | 3.0 |
| 21 | FM OSC | | 3.0 | 3.0 |
| 22 | $V_{CC1}$ ($V_{CC}$ for RF Stage) | — | 3.0 | 3.0 |
| 23 | FM RF OUT | cf. pin① | 3.0 | 3.0 |
| 24 | AM RF IN | | 3.0 | 3.0 |

**MAXIMUM RATINGS** ($Ta = 25°C$)

| CHARACTERISTIC | | SYMBOL | RATING | UNIT |
|---|---|---|---|---|
| Supply Voltage | | $V_{CC}$ | 8 | V |
| LED Current | | $I_{LED}$ | 10 | mA |
| LED Voltage | | $V_{LED}$ | 8 | V |
| Power Dissipation | TA8127N | $P_D$ (Note) | 1200 | mW |
| | TA8127F | | 400 | |
| Operating Temperature | | $T_{opr}$ | −25~75 | °C |
| Storage Temperature | | $T_{stg}$ | −55~150 | °C |

Note : Derated above 25°C in the proportion of 9.6mW / °C for TA8127N and of 3.2mW / °C for TA8127F.

**ELECTRICAL CHARACTERISTICS**

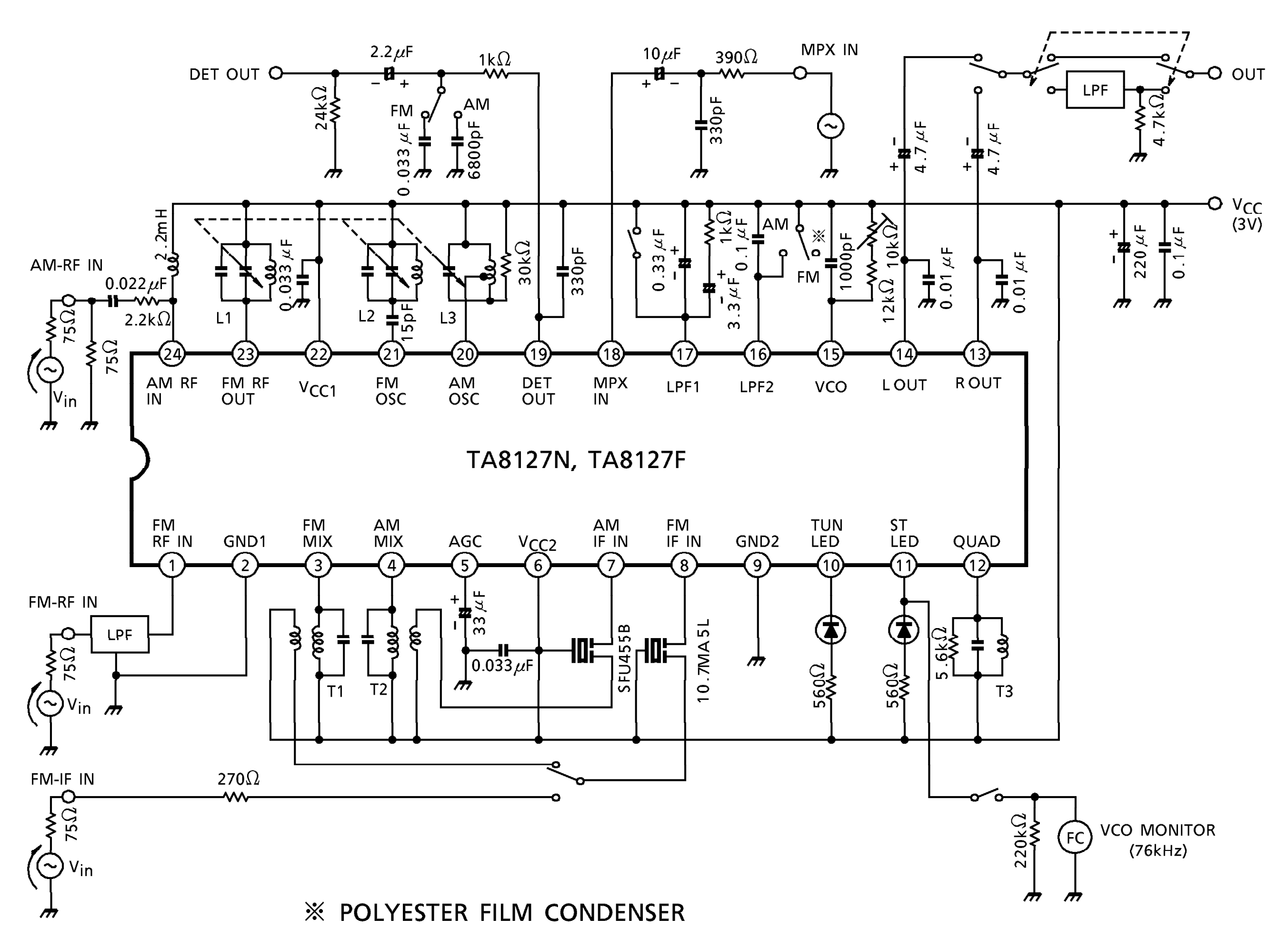
Unless otherwise specified,

Ta = 25°C, $V_{CC}$ = 3V, F / E : f = 83MHz, $f_m$ = 1kHz
FM IF : f = 10.7MHz, Δf = ±22.5kHz, $f_m$ = 1kHz
AM : f = 1MHz, MOD = 30%, $f_m$ = 1kHz
MPX : $f_m$ = 1kHz

| CHARACTERISTIC | | SYMBOL | TEST CIR-CUIT | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|---|---|
| Supply Current | | $I_{CC\,(FM)}$ | 1 | $V_{in}$ = 0, FM Mode | — | 13.2 | 20.0 | mA |
| | | $I_{CC\,(AM)}$ | 1 | $V_{in}$ = 0, AM Mode | — | 8.4 | 13.5 | |
| F / E | Input Limiting Voltage | $V_{in\,(lim.)}$ | 1 | −3dB Limiting | — | 10.0 | — | dBμV EMF |
| | Local OSC Voltage | $V_{OSC}$ | 2 | $f_{OSC}$ = 72.3MHz | — | 105 | — | $mV_{rms}$ |
| FM IF | Input Limiting Voltage | $V_{in\,(lim.)}$ IF | 1 | −3dB Limiting | 40 | 46 | 53 | dBμV EMF |
| | Recovered Output Voltage | $V_{OD}$ | 1 | $V_{in}$ = 80dBμV EMF | 55 | 80 | 110 | $mV_{rms}$ |
| | Signal to Noise Ratio | S / N | 1 | $V_{in}$ = 80dBμV EMF | — | 70 | — | dB |
| | Total Harmonic Distortion | THD | 1 | $V_{in}$ = 80dBμV EMF | — | 0.4 | — | % |
| | AM Rejection Ratio | AMR | 1 | $V_{in}$ = 80dBμV EMF | — | 32 | — | dB |
| | Lamp ON sensitivity | $V_L$ | 1 | $I_L$ = 1mA | 45 | 51 | 56 | dBμV EMF |
| AM | Gain | $G_V$ | 1 | $V_{in}$ = 26dBμV EMF | 40 | 70 | 110 | $mV_{rms}$ |
| | Recovered Output Voltage | $V_{OD}$ | 1 | $V_{in}$ = 60dBμV EMF | 55 | 80 | 110 | |
| | Signal to Noise Ratio | S / N | 1 | $V_{in}$ = 60dBμV EMF | — | 42 | — | dB |
| | Total Harmonic Distortion | THD | 1 | $V_{in}$ = 60dBμV EMF | — | 1.0 | — | % |
| | Lamp ON Sensitivity | $V_L$ | 1 | $I_L$ = 1mA | 20 | 25 | 30 | dBμV EMF |
| Pin⑲ Output Resistance | | $R_{19}$ | 1 | FM Mode | — | 0.75 | — | kΩ |
| | | | | AM Mode | — | 12.5 | — | |

| | CHARACTERISTIC | | SYMBOL | TEST CIRCUIT | TEST CONDITION | | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| MPX | Input Resistance | | $R_{IN}$ | — | — | | — | 24 | — | kΩ |
| | Output Resistance | | $R_{OUT}$ | — | — | | — | 5 | — | |
| | Max. Composite Signal Input Voltage | | $V_{in\ (max.)}$ STEREO | 1 | L + R = 90%, P = 10% $f_m$ = 1kHz, THD = 3% | | — | 350 | — | $mV_{rms}$ |
| | Separation | | Sep | 1 | L + R = 135$mV_{rms}$ P = 15$mV_{rms}$ | $f_m$ = 100Hz | — | 42 | — | dB |
| | | | | | | $f_m$ = 1kHz | 35 | 42 | — | |
| | | | | | | $f_m$ = 10kHz | — | 42 | — | |
| | Total Harmonic Distortion | Monaural | THD (MONAURAL) | 1 | $V_{in}$ = 150$mV_{rms}$ | | — | 0.2 | — | % |
| | | Stereo | THD (STEREO) | | L + R = 135$mV_{rms}$, P = 15$mV_{rms}$ | | — | 0.2 | — | |
| | Voltage Gain | | $G_{V\ (MPX)}$ | 1 | $V_{in}$ = 150$mV_{rms}$ | | – 5 | – 3 | – 1 | dB |
| | Channel Balance | | C.B. | 1 | $V_{in}$ = 150$mV_{rms}$ | | – 2 | 0 | 2 | |
| | Stereo Lamp Sensitivity | ON | $V_{L\ (ON)}$ | 1 | Pilot Input | | — | 8 | 16 | $mV_{rms}$ |
| | | OFF | $V_{L\ (OFF)}$ | | Pilot Input | | 2 | 6 | — | |
| | Stereo Lamp Hysteresis | | $V_H$ | 1 | To LED turn off from LED turn on | | — | 2 | — | $mV_{rms}$ |
| | Capture Range | | C.R. | 1 | P = 15$mV_{rms}$ | | — | ± 3 | — | % |
| | Signal to Noise Ratio | | S / N | 1 | $V_{in}$ = 150$mV_{rms}$ | | — | 70 | — | dB |

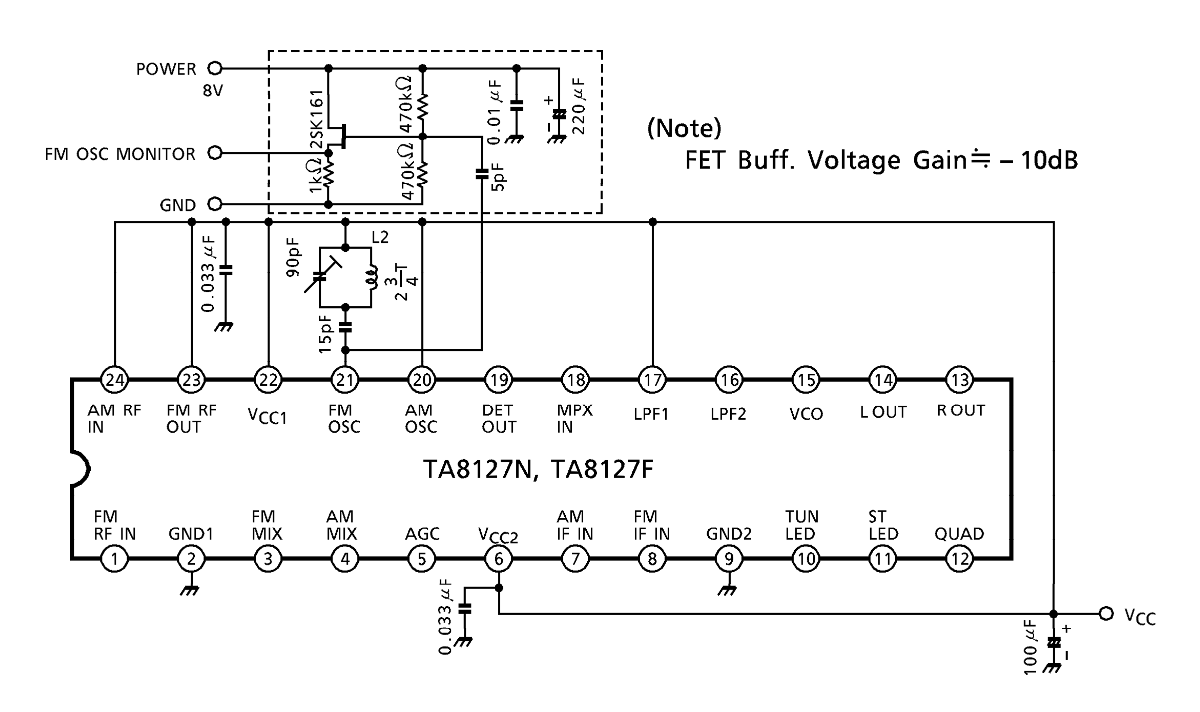
**TEST CIRCUIT 1**




※ POLYESTER FILM CONDENSER

Using other types of condensers, there are some cases that the MPX does not do normal stereo action at high temperature or low temperature.

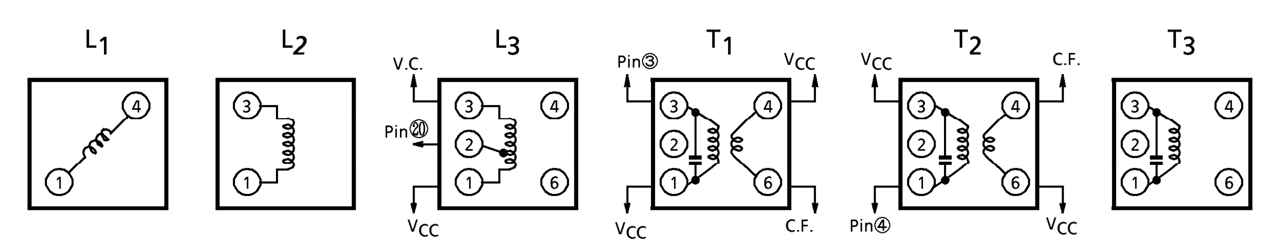
**TEST CIRCUIT 2**




**COIL DATA**

| COIL No. | TEST FREQ. (Hz) | L (μH) | $C_o$ (pF) | $Q_o$ | TURNS 1-2 | TURNS 2-3 | TURNS 1-3 | TURNS 1-4 | TURNS 4-6 | WIRE (mmφ) | REFERENCE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $L_1$ FM RF | 100M | — | — | 100 | — | — | — | 2 1/2 | — | 0.5UEW | Ⓢ 53T-037-202 |
| $L_2$ FM OSC | 100M | — | — | 100 | — | — | 2 3/4 | — | — | 0.5UEW | Ⓢ 0258-244 |
| $L_3$ AM OSC | 796k | 288 | — | 115 | 13 | 73 | — | — | — | 0.08UEW | Ⓢ 4147-1356-038 |
| $T_1$ FM MIX | 10.7M | — | 75 | 100 | — | — | 13 | — | 2 | 0.1UEW | Ⓢ 2153-414-041 |
| $T_2$ AM MIX | 455k | — | 180 | 120 | — | — | 180 | — | 15 | 0.08UEW | Ⓢ 2150-2162-165 |
| $T_3$ FM DET | 10.7M | — | 47 | 165 | — | — | 16 | — | — | 0.09UEW | Ⓢ 2153-4095-122 |

Ⓢ : SUMIDA ELECTRIC CO., LTD



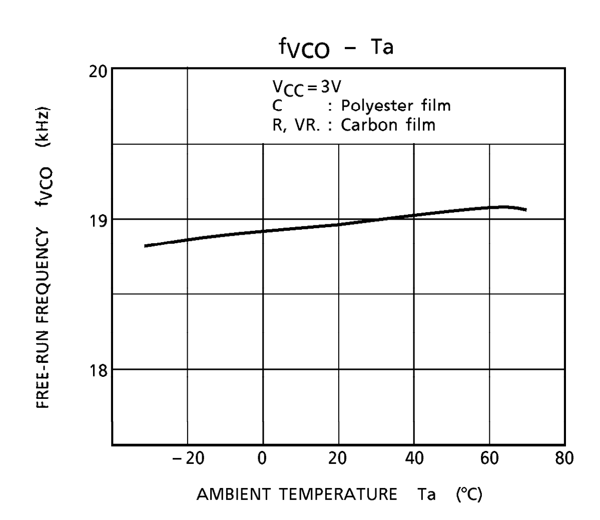
## HINT ON USE OF TA8127N and TA8127F

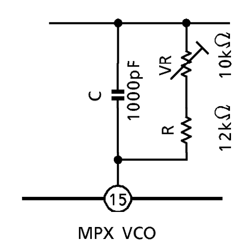
External Parts of MPX VCO

(1) Temperature characteristic of MPX VCO free-run frequency. The temperature characteristic of MPX VCO is shown in the diagram as below. Select one with a better temperature characteristic (C, R and VR.) in use. We recommend,

C : POLYESTER FILM

R, VR. : CARBON FILM



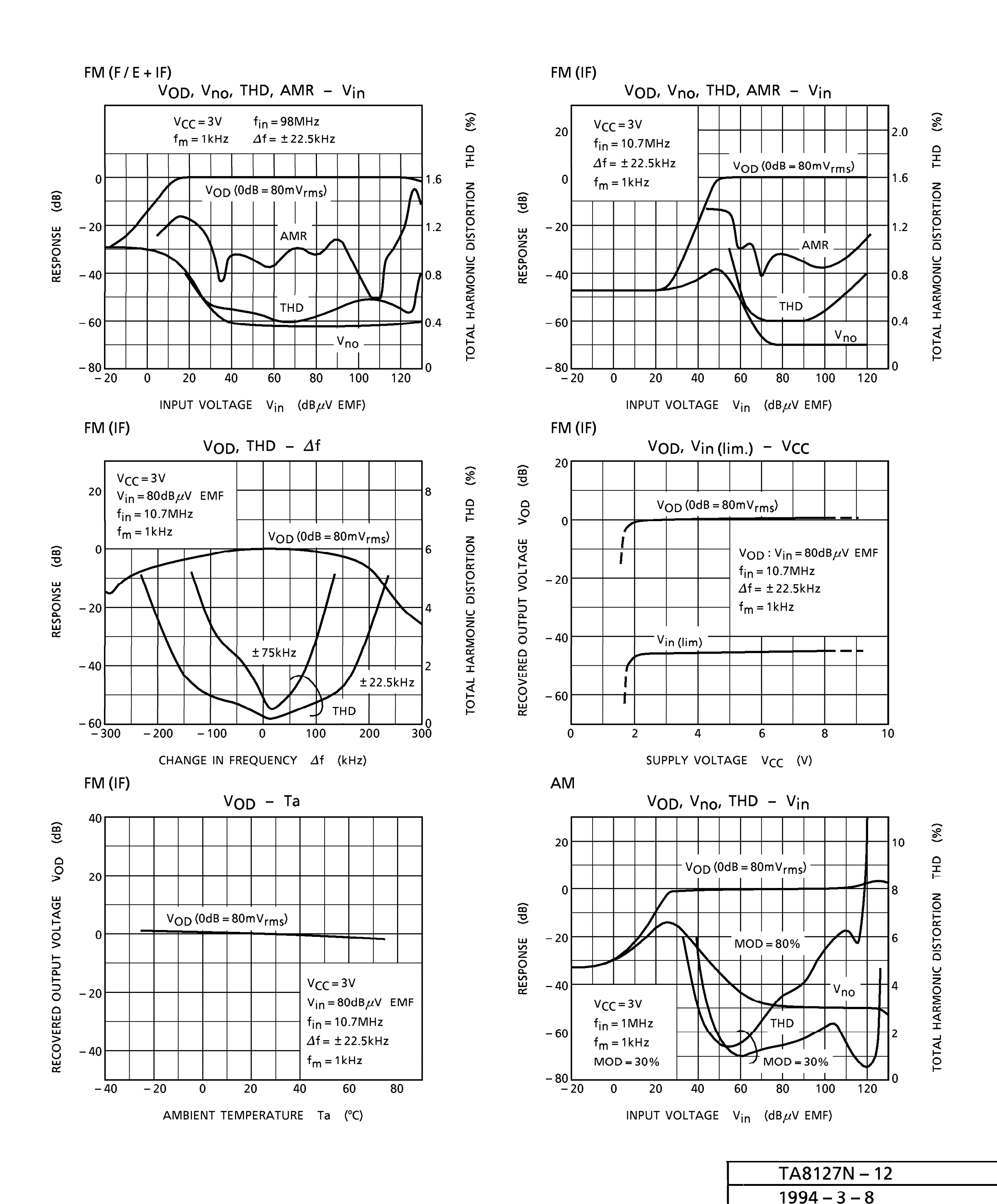

(2) Value of the external parts

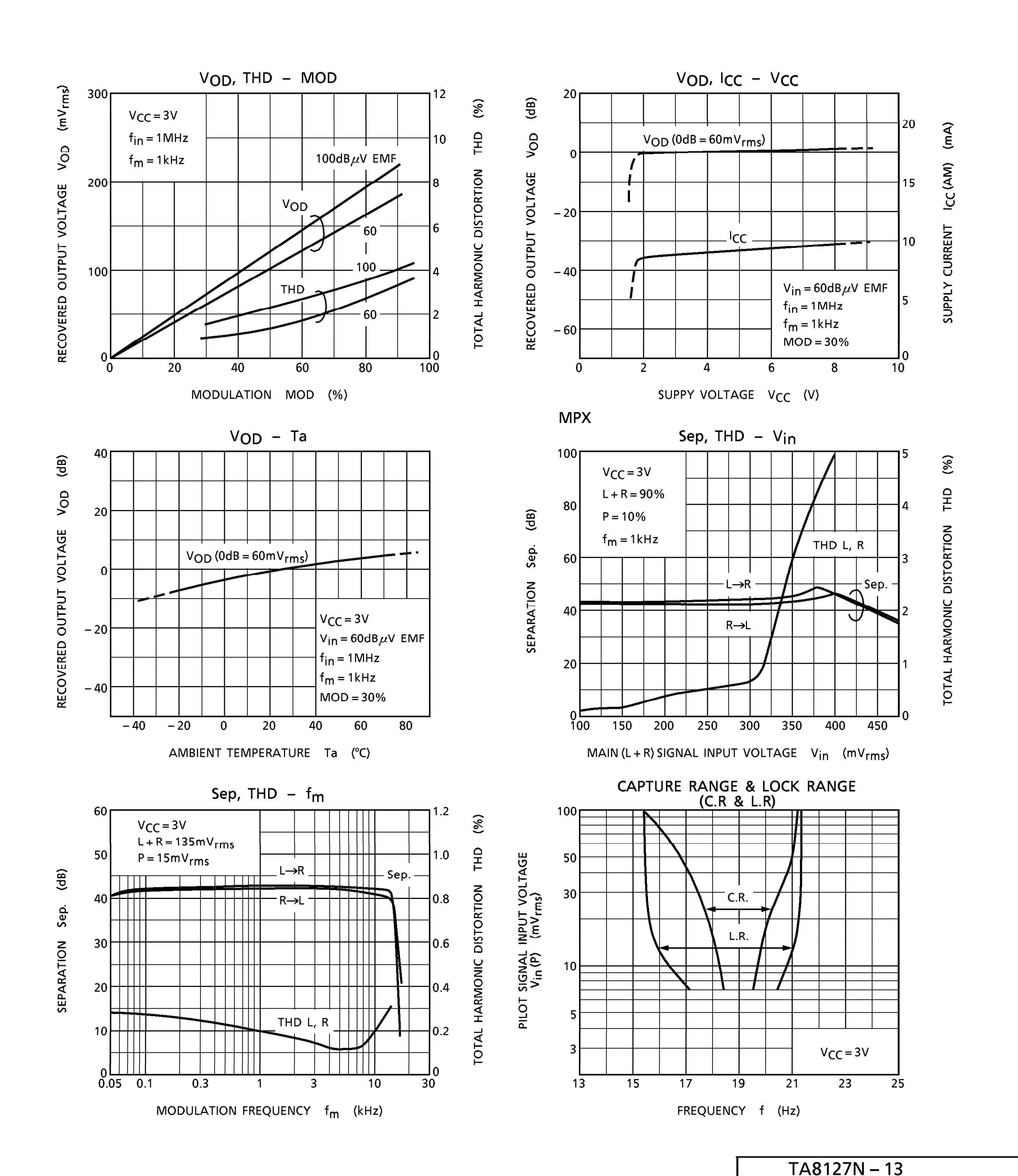
We recommend to set up these value as below.

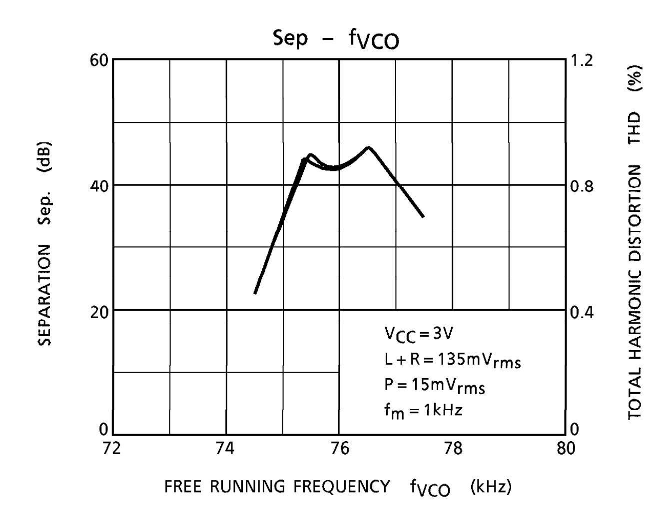
R = 12kΩ

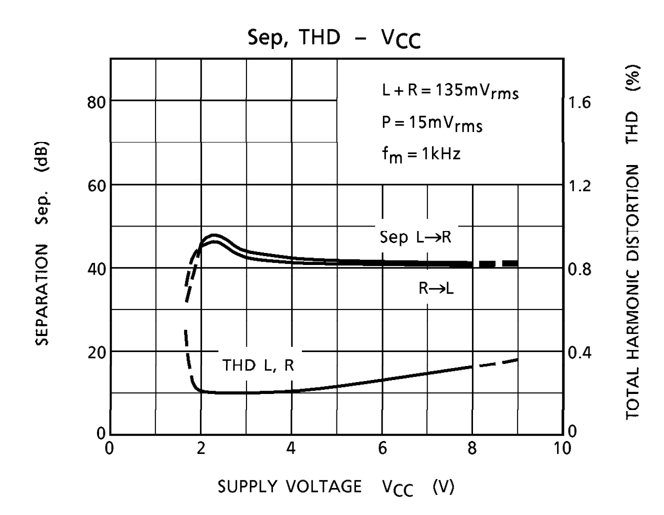
VR = 10kΩ

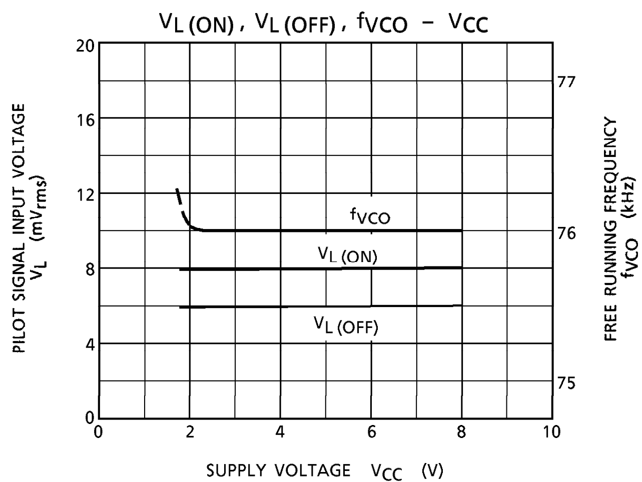
C = 1000pF


FM (F / E + IF)
$V_{OD}$, $V_{no}$, THD, AMR – $V_{in}$
$V_{CC}$ = 3V
$f_{in}$ = 98MHz
$f_m$ = 1kHz
$\Delta f$ = ±22.5kHz
$V_{OD}$ (0dB = 80m$V_{rms}$)
AMR
THD
$V_{no}$
RESPONSE (dB)
TOTAL HARMONIC DISTORTION THD (%)
INPUT VOLTAGE $V_{in}$ (dBμV EMF)
FM (IF)
$V_{OD}$, $V_{no}$, THD, AMR – $V_{in}$
$V_{CC}$ = 3V
$f_{in}$ = 10.7MHz
$\Delta f$ = ±22.5kHz
$f_m$ = 1kHz
$V_{OD}$ (0dB = 80m$V_{rms}$)
AMR
THD
$V_{no}$
RESPONSE (dB)
TOTAL HARMONIC DISTORTION THD (%)
INPUT VOLTAGE $V_{in}$ (dBμV EMF)
FM (IF)
$V_{OD}$, THD – $\Delta f$
$V_{CC}$ = 3V
$V_{in}$ = 80dBμV EMF
$f_{in}$ = 10.7MHz
$f_m$ = 1kHz
$V_{OD}$ (0dB = 80m$V_{rms}$)
±75kHz
±22.5kHz
THD
RESPONSE (dB)
TOTAL HARMONIC DISTORTION THD (%)
CHANGE IN FREQUENCY $\Delta f$ (kHz)
FM (IF)
$V_{OD}$, $V_{in (lim.)}$ – $V_{CC}$
$V_{OD}$ (0dB = 80m$V_{rms}$)
$V_{OD}$ : $V_{in}$ = 80dBμV EMF
$f_{in}$ = 10.7MHz
$\Delta f$ = ±22.5kHz
$f_m$ = 1kHz
$V_{in (lim)}$
RECOVERED OUTPUT VOLTAGE $V_{OD}$ (dB)
SUPPLY VOLTAGE $V_{CC}$ (V)
FM (IF)
$V_{OD}$ – Ta
$V_{OD}$ (0dB = 80m$V_{rms}$)
$V_{CC}$ = 3V
$V_{in}$ = 80dBμV EMF
$f_{in}$ = 10.7MHz
$\Delta f$ = ±22.5kHz
$f_m$ = 1kHz
RECOVERED OUTPUT VOLTAGE $V_{OD}$ (dB)
AMBIENT TEMPERATURE Ta (°C)
AM
$V_{OD}$, $V_{no}$, THD – $V_{in}$
$V_{OD}$ (0dB = 80m$V_{rms}$)
MOD = 80%
$V_{no}$
THD
MOD = 30%
$V_{CC}$ = 3V
$f_{in}$ = 1MHz
$f_m$ = 1kHz
MOD = 30%
RESPONSE (dB)
TOTAL HARMONIC DISTORTION THD (%)
INPUT VOLTAGE $V_{in}$ (dBμV EMF)


VOD, THD – MOD
VCC = 3V
fin = 1MHz
fm = 1kHz
100dBμV EMF
VOD
60
100
THD
60
RECOVERED OUTPUT VOLTAGE VOD (mVrms)
TOTAL HARMONIC DISTORTION THD (%)
MODULATION MOD (%)
VOD, ICC – VCC
VOD (0dB = 60mVrms)
ICC
Vin = 60dBμV EMF
fin = 1MHz
fm = 1kHz
MOD = 30%
RECOVERED OUTPUT VOLTAGE VOD (dB)
SUPPLY CURRENT ICC (AM) (mA)
SUPPY VOLTAGE VCC (V)
VOD – Ta
VOD (0dB = 60mVrms)
VCC = 3V
Vin = 60dBμV EMF
fin = 1MHz
fm = 1kHz
MOD = 30%
RECOVERED OUTPUT VOLTAGE VOD (dB)
AMBIENT TEMPERATURE Ta (°C)
MPX
Sep, THD – Vin
VCC = 3V
L + R = 90%
P = 10%
fm = 1kHz
THD L, R
L→R
Sep.
R→L
SEPARATION Sep. (dB)
TOTAL HARMONIC DISTORTION THD (%)
MAIN (L + R) SIGNAL INPUT VOLTAGE Vin (mVrms)
Sep, THD – fm
VCC = 3V
L + R = 135mVrms
P = 15mVrms
L→R
Sep.
R→L
THD L, R
SEPARATION Sep. (dB)
TOTAL HARMONIC DISTORTION THD (%)
MODULATION FREQUENCY fm (kHz)
CAPTURE RANGE & LOCK RANGE
(C.R & L.R)
C.R.
L.R.
VCC = 3V
PILOT SIGNAL INPUT VOLTAGE Vin(P) (mVrms)
FREQUENCY f (Hz)

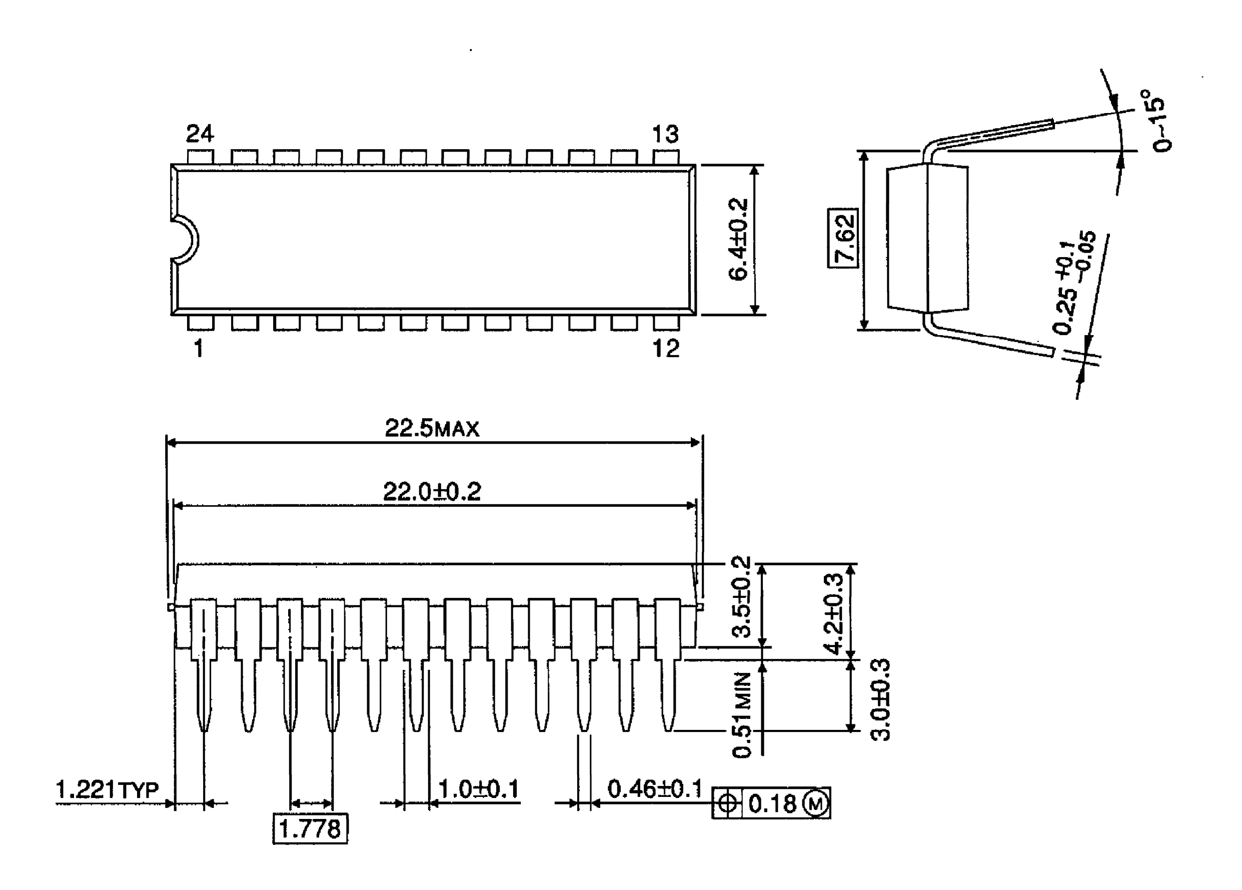

Sep – fVCO
SEPARATION Sep. (dB)
TOTAL HARMONIC DISTORTION THD (%)
FREE RUNNING FREQUENCY fVCO (kHz)
VCC = 3V
L + R = 135mVrms
P = 15mVrms
fm = 1kHz
60
40
20
0
1.2
0.8
0.4
0
72
74
76
78
80


Sep, THD – VCC
SEPARATION Sep. (dB)
TOTAL HARMONIC DISTORTION THD (%)
SUPPLY VOLTAGE VCC (V)
L + R = 135mVrms
P = 15mVrms
fm = 1kHz
Sep L→R
R→L
THD L, R
80
60
40
20
0
1.6
1.2
0.8
0.4
0
0
2
4
6
8
10


VL (ON), VL (OFF), fVCO – VCC
PILOT SIGNAL INPUT VOLTAGE VL (mVrms)
FREE RUNNING FREQUENCY fVCO (kHz)
SUPPLY VOLTAGE VCC (V)
fVCO
VL (ON)
VL (OFF)
20
16
12
8
4
0
77
76
75
0
2
4
6
8
10

**OUTLINE DRAWING**
SDIP24-P-300

Unit : mm

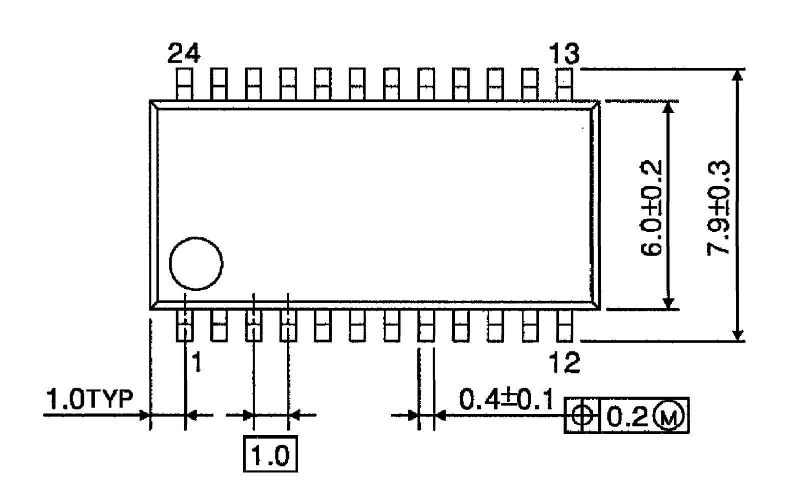


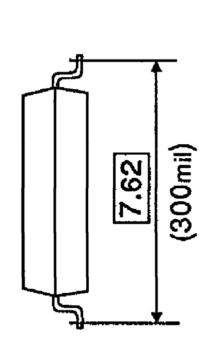

Weight : 1.2g (Typ.)

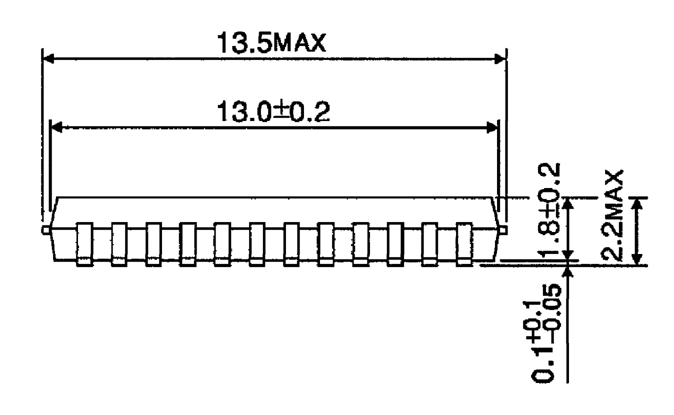
**OUTLINE DRAWING**

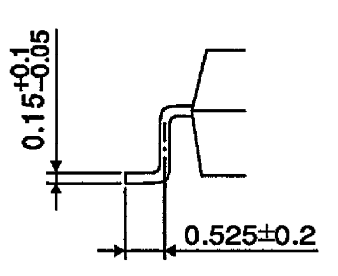
SSOP24-P-300

Unit : mm




Weight : 0.31g (Typ.)